Simulating the Effects of Foreign Trade Policies on Growth and Income Inequality: CGEM for the Moroccan Economy

Elbejnouni Ismail* and Zouiri Lahboub

Applied Economics Laboratory, Mohammed V University, Rabat, Morocco.

Abstract: This study investigates the implications of foreign trade policies on economic growth and internal income inequality in Morocco. While the country's integration into the global economy and trade liberalization have been prominent objectives, recent challenges such as the pandemic, inflation, and volatile raw material prices have sparked concerns about their impact on household well-being. Using a Computable General Equilibrium Model (CGEM) based on the Moroccan Social Accounting Matrix (SAM) for 2019, the study finds that full trade liberalization has a negative effect on GDP growth, while anti-liberal trade policies have a positive impact. However, the influence on well-being measures and income inequality is relatively modest and statistically less significant, highlighting the intricate relationship between foreign trade policies and income disparities within a small, open economy like Morocco.

Keywords: Economic growth, trade policies, income inequality, CGEM.

JEL Classifications: F43; F13; D63; C68.

1. INTRODUCTION

The ultimate objective of political economy is to examine the complex interactions between economic actors and social structures as well as the effects of these interactions on economic and social well-being. In Morocco, the decisions made, influenced, and implemented by political actors are increasingly oriented towards greater integration into the global economy. This vision is supported, among other factors, by the advanced state of trade liberalization. However, the negative repercussions of the pandemic crisis, inflation, and the surge in prices of raw materials in the international market have reignited the debate on the impact of these decisions on the living standards of households. This context highlights the importance of conducting a comprehensive investigation into the effects of foreign trade policies on economic growth and internal income inequality in Morocco.

Through the use of different econometric methods, the empirical literature on the relationship between foreign trade policies and economic growth showed the positive effects of trade openness and effective trade policies on economic growth, productivity growth, and overall development. It also showed how important institutional factors are in shaping this relationship. The studies conducted by Frankel, Romer, and Cyrus (1996) and Edwards (1998) highlighted a significant positive effect of trade openness on economic growth, with countries that exhibit higher levels of trade experiencing higher growth rates. Dollar (1992) and Sachs and Warner (1997) emphasized the benefits of outward-oriented trade policies, showing that economies focusing on exports and open to international trade achieve higher growth rates compared to inward-oriented economies.

Dollar and Kraay (2003) emphasized the moderating role of institutional quality in the relationship between trade openness and economic growth, with countries possessing stronger institutions benefiting more from trade openness. Romer (1993) underscored the importance of trade policies in facilitating knowledge transfer and technology diffusion and contributing to economic development. Finally, Rodrik (2005) highlighted the significance of well-designed trade policies in promoting economic growth, particularly through export-oriented strategies.

On the relationship between foreign trade policies and income inequality, the empirical literature presented mixed findings. Rodriguez and Rodrik (2000) highlighted the context-specific nature of the impact of trade policy on income inequality, with outcomes dependent on factors such as institutional quality and complementary policies. Dollar and Kraay (2004) found that increased trade openness is associated with a reduction in poverty levels, suggesting a potential positive effect on income inequality. Goldberg and Pavcnik (2007) reviewed globalization's distributional effects and found that trade liberalization can have varying impacts on income inequality within developing countries, depending on factors such as skill levels and sectoral composition.

Harrison and McLaren (2010) suggested that greater trade openness is associated with more tolerant social attitudes, which can contribute to reducing income inequality by promoting inclusiveness. Milanovic (2016) provided a global analysis of income inequality, considering the role of globalization, including trade liberalization, in shaping income disparities within and across nations. Abdelkhalek (2005) found a weak and statistically insignificant impact of trade

*Address correspondence to this author at the Applied Economics Laboratory, Mohammed V University, Rabat, Morocco; Tel: +212649889224,
E-mail: ismail.elbej@gmail.com

liberalization on poverty and inequality measures in Morocco, while Mabugu and Chitiga (2007) showed that increased tariff protection in South Africa leads to long-term declines in GDP and well-being.

Given the potential consequences of international trade policies on economic growth and their social costs for different household categories, the main question arises as to whether there is a need to further push trade liberalization, take a step back, or even consider certain hardening measures. To address this issue, this study utilizes a Computable General Equilibrium Model (CGEM) to better understand the implications of these policies, both on macroeconomic aggregates, particularly economic growth, and on the living levels of different groups of households, with special attention to internal income inequality.

The accounting framework of the CGE model used in this study is based specifically on the Moroccan Social Accounting Matrix (SAM) for 2019. Adapting the SAM to address our research question requires incorporating two additional summary tables: The Supply and Use Table (SUT) for 2019 and the Integrated Economic Accounts Table (IEAT) for the same year. Additionally, data from the National Household Consumption and Expenditure Survey 2013–2014 (NHCES) is used. The theoretical framework of the CGE model is built upon the PEP 1-1 model, which allows for a detailed examination of the effects of foreign trade policies on various economic variables.

The main findings of this study revealed that the impact of full trade liberalization on GDP growth is negative, while anti-liberal trade policies have a positive effect. However, the impact on well-being measures and income inequality is relatively modest and statistically less significant compared to its influence on GDP growth. These results confirm, under the assumptions of a small, open economy, the complex and nuanced relationship between foreign trade policies and internal income inequality, whether the approach is liberal or protectionist in nature.

In what follows, the article is presented in multiple sections. It begins by introducing the Computable General Equilibrium Model (CGEM), presenting both the accounting and the theoretical framework of the model. The following section focuses on the simulation of economic policies and provides a detailed analysis of the resulting outcomes. Finally, the article concludes by summarizing the findings and discussing their implications.

2. PRESENTATION OF THE COMPUTABLE GENERAL EQUILIBRIUM MODEL

The computable general equilibrium (CGE) model is a mathematical framework used by economists to analyze the impacts of economic policies and external shocks on the overall economy. It provides a comprehensive understanding of how different sectors, households, and markets interact with each other. By simultaneously solving a set of equations that describe the economic behavior of various agents, the CGE model captures the equilibrium values of economic variables in the economy. This enables policymakers to simulate the effects of different policy scenarios and evaluate their impact on sectors, households, and overall welfare. Additionally, the CGE model allows for the examination of distributional effects, helping policymakers identify how different groups of households are affected by economic policies. With its ability to analyze macroeconomic and microeconomic effects, the CGE model supports evidence-based policymaking by providing insights into the potential winners and losers of different policy options and facilitating the design of policies that promote inclusive economic growth and well-being for all segments of society.

Through this work, we seek to apply this tool to better understand the implications of foreign trade policies, both on macroeconomic aggregates, particularly economic growth, and on the living levels of different groups of households, with special attention to internal income inequality. To accomplish this, several steps must be taken, including defining the model's scope (deciding which sectors and households to include in the model as well as the policy areas to be analyzed), developing the theoretical framework (model specifications), calibrating the model, testing the model, and using it for analysis. Each step is critical to ensuring that the model accurately represents the real economy of the nation under consideration and can be used to solve the problem at hand.

2.1. Accounting framework of the CGE model: The Moroccan Social Accounting Matrix for 2019

A SAM is a one-year snapshot of an economy. It must be square because each account appears in the table as both a row and a column: the account's income is shown in the corresponding row, and its expenditures are shown in the corresponding column. As a result, the value in each cell of the matrix is an expense for the associated column account and an income for the corresponding row account. The SAM used as the basis for a CGE model must be balanced, which means that the sum of income from all sources must be exactly equal to the sum of expenditures for each account. In this study, we used the Moroccan social accounting matrix for the year 2019. The year was chosen for two reasons: first, to use the most recent database; and second, the matrix data must reflect the economic activity of a so-called normal year.

The first step in adapting[1] the SAM is to convert it from its raw state to a usable state, at which point the SAM should be categorized into five major accounts: the factors of production account, the institutional agents account, the commodities account, the industries account, and finally the accumulation account.

The next stage is to cancel the account mentioned on the matrix as 'U99,' which signifies the territorial correction account according to the 2014 national accounting nomenclature. To do so, we recalculated the values of final household consumption and imports, considering the differences between the consumption of residents in the rest of the world and the consumption of non-residents in Morocco.

Then, for reasons related to our issue, we disaggregated the government account to extract direct taxes, indirect taxes on

[1] We adapted our SAM based on the instructions given by Decaluwé, Lemelin, Maisonnave and Rochibud (2010).

commodities, and import taxes. Besides the data appearing on the 2019 SAM, the disaggregation is accomplished through the use of two other synthesis tables: the supply and use table (SUT) for 2019 and the integrated economic accounts table (IEAT) for the same year.

To identify the impact of foreign trade policies on the living standards of different social classes, we have broken down the account of households according to income and consumption expenditures into three sub-accounts: the poorest households (PHH), which correspond to the first quintile of income; the middle-class households (MHH), which correspond to the second, third, and fourth quintiles of income; and the wealthiest households (WHH), which correspond to the fifth quintile of income. In order to accomplish this disaggregation, we used both data from the National Household Consumption and Expenditures Survey 2013–2014 (NHCES) (Au Plan, 2018) and data extracted from reports[2] on Morocco's social indicators provided by the High Commission for Planning (Au Plan, 2020, 2022).

Then, we divided two more accounts since we felt it was vital to have more information in our matrix and, consequently, in the findings. First, we divided the commodities account to distinguish between the supply intended for the local market and that intended for the export market. This stage is very convenient for representing exports at both producer and purchaser prices. Additionally, it makes it easier to take into consideration situations where various industries sell varying percentages of their production on domestic and foreign markets for a given commodity. Second, we split the accumulation account into two parts: savings/investment (INV) and inventory changes (VSTK). Once again, we used data from the supply and use table for 2019 to differentiate between gross fixed capital formation and inventory changes.

For reasons related to our problem, we have reduced the size of the model by aggregating the industrial sectors into four key sectors instead of twenty-eight sectors and the commodities into five products instead of twenty-eight products, four of which are exportable.

The final version of the matrix is composed of five major accounts, each of which is subdivided into multiple subaccounts based on the problem studied and the extent of disaggregation desired, which defines the size of the SAM. The structure, accounts, and dimensions of the SAM used in the present work are presented in the appendices.

2.2. Theoretical Framework of the CGE Model: The PEP 1-1 Model

The CGE model used in this study draws inspiration from the PEP 1-1 model, a single-country, static version by Decaluwé *et al.* (2010). In what follows, we will first detail its equations and underlying assumptions, and then the model's calibration and closure. The structure of the model is shown in the appendices.

2.2.1. Model Specifications

The model equations are grouped below into eight large blocks of equations and presented following the method suggested in Decaluwé, Martens, and Savard (2001).

Block of production equations. The sectoral output of each productive activity in the selected specification is first thought to be a fixed combination of value added and total intermediate consumption according to a Leontief production function; this indicates that the two total inputs are strictly complementary with no option for substitution (equations 1 and 2).

$$VA_j = v_j\, XST_j \tag{1}$$

$$CI_j = io_j\, XST_j \tag{2}$$

Next, according to a constant elasticity of substitution (CES) specification (equation 3), the value added for each industry consists of a combination of labor and capital.

$$VA_j = B_j^{VA}\left[\beta_j^{VA}\, LD_j^{-\rho_j^{VA}} + \left(1-\beta_j^{VA}\right) KD_j^{-\rho_j^{VA}}\right]^{-\frac{1}{\rho_j^{VA}}} \tag{3}$$

Firms use labor and capital to a level where each input's marginal product value is equal to its price in an effort to maximize profits (or reduce costs). This tendency, as described in the following equation, determines the demand for labor relative to capital.

$$LD_j = \left[\frac{\beta_j^{VA}}{1-\beta_j^{VA}}\frac{R_j}{W}\right]^{\sigma_j^{VA}} KD_j \quad \text{With} \quad \rho_j^{VA} = \frac{1-\sigma_j^{VA}}{\sigma_j^{VA}};$$

$$0 < \sigma_j^{VA} < \infty \tag{4}$$

Finally, a variety of commodities and services make up aggregate intermediate consumption. In equation 5 below, it is assumed that the intermediate inputs mix according to a Leontief production function and are completely complementary. Substitutions cannot be made.

$$DI_{i,j} = aij_{i,j} CI_j \tag{5}$$

Block of income and savings equations. Starting with households, the three sources of their income are labor income, capital income, and transfers received from other agents (equation 6).

$$YH_h = YHL_h + YHK_h + YHTR_h \tag{6}$$

Equation 7 states that each group of households receives a fixed portion of the labor wages. The distribution of total capital income among agents, including households, is also done in fixed proportions (equation 8). Finally, the total of all transfers received by each group of households constitutes its transfer income (equation 9).

$$YHL_h = \lambda_h^W \left(W \sum_j LD_j\right) \tag{7}$$

$$YHK_h = \lambda_h^R \left(\sum_j R_j\, KD_j\right) \tag{8}$$

2 Social indicators of Morocco 2019 ; Social indicators of Morocco 2020.

$$YHTR_h = \sum_{ag} TR_{h,ag} \quad (9)$$

Each group of households disposable income (equation 10) is the result of deducting direct taxes and household transfers to the government. After transfers to other agents and savings, all remaining disposable income is used for consumption only (equation 11).

$$YDH_h = YH_h - DTH_h - TR_{gvt,h} \quad (10)$$

$$CTH_h = YDH_h - SH_h - \sum_{agng} TR_{agng,h} \quad (11)$$

Contrary to the usual specification, in which savings are a fixed proportion of income, household savings are a linear function of disposable income. Equation 12 allows the marginal propensity to save to differ from the average propensity, enabling a more accurate depiction of household behavior, especially when negative savings are seen in some household categories. Moreover, equation 12 allows for full or partial indexing of the intercept to changes in the consumer price index.

$$SH_h = CPIX^{\eta}\ sh0_h + sh1_h\ YDH_h \quad (12)$$

The income generated by the business is made up of transfers from other agents as well as its part of capital income. Disposable income is obtained by deducting business income taxes from total income (equation 16). Similarly, after deducting transfers to other agents from disposable income, business savings are what's left over (equation 17).

$$YF = YFK + YFTR \quad (13)$$

$$YFK = \lambda_f^R \left(\sum_j R_j\ KD_j\right) \quad (14)$$

$$YFTR = \sum_{ag} TR_{f,ag} \quad (15)$$

$$YDF = YF - DTF \quad (16)$$

$$SF = YDF - \sum_{ag} TR_{ag,f} \quad (17)$$

The government acquires funding through income taxes on households and businesses, taxes on products (TPCTS) - which include indirect taxes on consumption and taxes and duties on imports - and other taxes on production. Additionally, the government receives part of the capital compensation and transfers from all agents. Equations 18 to 25 outline the various sources of government funding.

$$YG = TDTH + DTF + TPCTS + TIPT + YGK + YGTR \quad (18)$$

$$TDTH = \sum_h DTH_h \quad (19)$$

$$TPCTS = TICT + TIMT \quad (20)$$

$$TICT = \sum_i TIC_i \quad (21)$$

$$TIMT = \sum_i TIM_i \quad (22)$$

$$TIPT = \sum_j TIP_j \quad (23)$$

$$YGK = \lambda_{gvt}^R \left(\sum_j R_j\ KD_j\right) \quad (24)$$

$$YGTR = \sum_{ag} TR_{gvt,ag} \quad (25)$$

Income taxes are characterized as a linear function of total income, whether for households (equation 26) or for firms (equation 27), similar to what has been done with household savings. In this manner, the marginal tax rate differs from the average tax rate when a non-zero intercept is used. The intercept, once more, may be either fully or partially indexed to changes in the consumer price index.

$$DTH_h = CPIX^{\eta}\ tdth0_h + tdth1_h\ YH_h \quad (26)$$

$$DTF = CPIX^{\eta} tdtf0 + tdtf1\ YFK \quad (27)$$

Revenue generated by the government from indirect taxes on products is determined by considering the sales value, including trade and transport margins (equation 28). Other taxes are collected, including taxes and duties on imported products (equation 29), as well as taxes on industry's production, which are applied to the total production value (equation 30). We note that in our specification, taxes are depicted as the difference between the amounts of taxes and subsidies.

$$TIC_i = ttic_i \begin{bmatrix} \left(PL_i + \sum_{ij}\ PC_{ij}\ tmrg_{ij,i}\right) DD_i + \\ \left(\left(1 + ttim_i\right) PWM_i\ e + \sum_{ij}\ PC_{ij}\ tmrg_{ij,i}\right) IM_i \end{bmatrix} \quad (28)$$

$$TIM_i = ttim_i\ PWM_i\ e\ IM_i \quad (29)$$

$$TIP_j = ttip_j\ PP_j\ XST_j \quad (30)$$

Finally, government savings are calculated by subtracting its expenditures from its revenue. These expenditures consist of transfers to all agents and current spending on goods and services.

$$SG = YG - \sum_{ag} TR_{ag,gvt} - G \quad (31)$$

The rest of the world obtains payments for the value of imports, a portion of capital income, and transfers from domestic agents (equation 32). Expenditures by foreign entities in the domestic economy include the value of exports and transfers to domestic agents. The discrepancy between foreign earnings and spending equates to the rest-of-the-world savings (equation 33), which share the same absolute value as the current account balance but have an opposite sign (equation 34).

$$YROW = e\ \sum_i PWM_i\ IM_i + \lambda^R_{row}\left(\sum_j R_j\ KD_j\right) + \sum_{agd} TR_{row,agd} \quad (32)$$

$$SROW = YROW - \sum_i PE_i^{FOB}\ EXD_i - \sum_{agd} TR_{agd,row} \quad (33)$$

$$SROW = -CAB \quad (34)$$

Handling transfers within a CGE model is often difficult due to their intangible nature and lack of ties to specific economic behaviors. Given the limited information on each transfer type, they must be treated neutrally to prevent affecting economic agents' behavior. As a result, household transfers to non-government agents and business transfers are proportional to disposable income. Household transfers to the government, similar to social program contributions, are addressed like household income taxes. Lastly, all remaining transfers are initially set at their SAM values and are indexed, either completely or partially, based on the consumer price index.

$$TR_{agng,h} = \lambda^{TR}_{agng,h}\ YDH_h \quad (35)$$

$$TR_{gvt,h} = CPIX^{\eta}\ tr0_h + tr1_h\ YH_h \quad (36)$$

$$TR_{ag,f} = \lambda^{TR}_{ag,f}\ YDF \quad (37)$$

$$TR_{ag,gvt} = CPIX^{\eta}\ TR^0_{ag,gvt} \quad (38)$$

$$TR_{ag,row} = CPIX^{\eta}\ TR^0_{ag,row} \quad (39)$$

Block of demand equations. Regardless of whether products and services are domestically produced or imported, their demand encompasses intermediary demand, household consumption demand, investment-related demand, government demand, and demand in the form of transportation or trade margins.

In contrast to the commonly used Cobb-Douglas utility functions seen in the literature, we have adopted Stone-Geary utility functions as employed by Decaluwé *et al.* (2010). The primary distinction between these utility functions lies in the presence of a minimum consumption level for each commodity in the Stone-Geary functions, resulting in a more realistic underlying assumption.

$$PC_i\ C_{i,h} = PC_i\ C^{MIN}_{i,h} + \gamma^{LES}_{i,h}\left(CTH_h - \sum_{ij} PC_{ij}\ C^{MIN}_{ij,h}\right) \quad (40)$$

Investment demand comprises both gross fixed capital formation (GFCF) and changes in inventories, which differ significantly. Specifically, GFCF cannot be negative, whereas changes in inventories can be either positive or negative. Incorporating negative inventory changes into a CGE model can be challenging, so to sidestep these issues, inventory changes are treated as exogenous and fixed in volume. Conversely, GFCF is treated as endogenous, with total investment expenditure determined by the savings-investment equilibrium constraint (equation 69), and savings are also endogenous.

GFCF expenditure is calculated by removing the cost of inventory changes from total investment expenditure (equation 41) and allocating it to commodities in fixed proportions (equation 42). This implicitly assumes that the quantity demanded of each commodity for investment purposes is inversely proportional to its purchaser price for a given investment expenditure amount. The same logic applies to government current expenditures on goods and services (equation 43), where the quantity demanded of each commodity varies inversely with its price given a specific current expenditure budget.

$$GFCF = TI - \sum_i PC_i\ VST_i \quad (41)$$

$$PC_i\ INV_i = \gamma_i^{INV}\ GFCF \quad (42)$$

$$PC_i\ CG_i = \gamma_i^{GVT}\ G \quad (43)$$

Besides their necessity for final demand, commodities also serve as inputs in the production process. The total intermediate demand for each commodity is the combined demand from all industries.

$$DIT_i = \sum_j\ DI_{i,j} \quad (44)$$

Finally, the demand for commodities in the form of transportation or trade margins is described by the following equation:

$$MRGN_i = \sum_{ij} tmrg_{i,ij}\ DD_{ij} + \sum_{ij} tmrg_{i,ij}\ IM_{ij} + \sum_{ij} tmrg^X_{i,ij}\ EXD_{ij} \quad (45)$$

Block of supply and international trade equations. At this phase, we outline the trade relationships with the rest of the world, encompassing the supply of exports and the demand for imports. This involves specifying the behavior of domestic consumers concerning various supply sources as well as the supply behavior of domestic producers. The latter includes two parts: firstly, the conversion of composite output into the supply of products; and secondly, the allocation of each product's supply to target markets. The small-country assumption is considered, implying that the world price of traded goods remains exogenous.

Given that industries usually produce multiple products, we chose a constant elasticity of transformation (CET) function (equation 46) to describe that although an industry can reorganize its production to change the proportions of commodities produced, the various products are not perfectly transformable into one another.

$$XST_j = B_j^{XT}\left[\sum_j\ \beta_{j,i}^{XT}\ XS_{j,i}^{\rho_j^{XT}}\right]^{\frac{1}{\rho_j^{XT}}} \quad (46)$$

Individual product supply functions are then given by equation 47.

$$XS_{j,i} = \frac{XST_j}{\left(B_j^{XT}\right)^{1+\sigma_j^{XT}}} \left[\frac{P_{j,i}}{\beta_{j,i}^{XT} PT_j}\right]^{\sigma_j^{XT}} \quad \text{With;} \quad \rho_j^{XT} = \frac{1+\sigma_j^{XT}}{\sigma_j^{XT}}; 0 < \sigma_j^{XT} < \infty \tag{47}$$

Next, considering the demand in each market and the relevant taxes, the production of every product in an industry is allocated among domestic or export markets in order to maximize the firm's total revenue. It is assumed that the output intended for one market may slightly differ from the output aimed at another market. The model incorporates a constant elasticity of transformation (CET) aggregator function (equation 48) to represent this imperfect substitutability, which defines the way that production can be redirected from one market to another.

$$XS_{j,i} = B_{j,i}^X \left[\beta_{j,i}^X EX_{j,i}^{\rho_{j,i}^X} + \left(1-\beta_{j,i}^X\right) DS_{j,i}^{\rho_{j,i}^X}\right]^{\frac{1}{\rho_{j,i}^X}} \tag{48}$$

Equation 49 represents then the relative supply functions.

$$EX_{j,i} = \left[\frac{1-\beta_{j,i}^X}{\beta_{j,i}^X} \frac{PE_i}{PL_i}\right]^{\sigma_{j,i}^X} DS_{j,i} \quad \text{With;} \quad \rho_{j,i}^X = \frac{1+\sigma_{j,i}^X}{\sigma_{j,i}^X}; 0 < \sigma_{j,i}^X < \infty \tag{49}$$

Contrary to what the majority of CGE models assume about the possibility for producers to sell any desired quantity in the global market, we choose to get in line with the small-country hypothesis, where equation 50 implies that a local producer can only expand their share of the world market by offering a price that is more competitive compared to the global price. The extent to which a producer can increase their market share depends on the price elasticity of export demand.

$$EXD_i = EXD_i^0 \left[\frac{e\, PWX_i}{PE_i^{FOB}}\right]^{\sigma_i^{XD}} \tag{50}$$

Regarding consumer behavior, a comparable approach is taken as for producer behavior, whereby it is assumed that domestic goods and imports are not perfect substitutes. Therefore, commodities that are in demand on the local market are considered composite products, comprising a blend of locally produced goods and imports. To account for this imperfect substitutability, a constant elasticity of substitution (CES) aggregator function (as represented in equation 51) is employed.

$$Q_i = B_i^M \left[\beta_i^M IM_i^{-\rho_i^M} + \left(1-\beta_i^M\right) DD_i^{-\rho_i^M}\right]^{\frac{-1}{\rho_i^M}} \tag{51}$$

Relative demand functions are then given by equation 52.

$$IM_i = \left[\frac{\beta_i^M}{1-\beta_i^M} \frac{PD_i}{PM_i}\right]^{\sigma_i^M} DD_i \quad \text{With;} \quad \rho_i^M = \frac{1-\sigma_i^M}{\sigma_i^M}; 0 < \sigma_i^M < \infty \tag{52}$$

Block of prices equations. As per equation 53, the determination of the unit cost of an industry's output, exclusive of production taxes, entails a weighted summation of the prices of value added and the aggregate intermediate consumption.

$$PP_j = \frac{PVA_j\, VA_j + PCI_j\, CI_j}{XST_j} \tag{53}$$

Equation 54 outlines that the basic price of production is calculated by adding production taxes to the unit cost.

$$PT_j = \left(1 + ttip_j\right) PP_j \tag{54}$$

Equation 55 demonstrates that the price of aggregate intermediate consumption is a synthesis of the commodity prices of an industry's intermediate inputs. Correspondingly, equation 56 establishes that the price of value added is a weighted sum of the prices of labor and capital.

$$PCI_j = \frac{\sum_i PC_i\, DI_{i,j}}{CI_j} \tag{55}$$

$$PVA_j = \frac{W\, LD_j + R_j\, KD_j}{VA_j} \tag{56}$$

As described in equation 57, the basic price acquired by industry j is illustrated as a weighted summation of its basic price on the domestic market and its basic price on the export market.

$$P_{j,i} = \frac{PE_i\, EX_{j,i} + PL_i\, DS_{j,i}}{XS_{j,i}} \tag{57}$$

The FOB price paid by consumers in the export market deviates from the amount received by the producer, as margins are required to be incorporated, as delineated in equation 58.

$$PE_i^{FOB} = PE_i + \sum_{ij} PC_{ij}\, tmrg_{ij,i}^X \tag{58}$$

Equation 59 outlines that the price paid for a local product is the result of adding the amount received by the producer, margins, and indirect taxes. Equation 60 similarly explicates that the price paid for an imported product includes the translation of the international price into the local currency, customs and taxes on imports, margins, and domestic indirect taxes.

$$PD_i = (1 + ttic_i)\left(PL_i + \sum_{ij} PC_{ij}\, tmrg_{ij,i}\right) \tag{59}$$

$$PM_i = (1 + ttic_i)\left((1 + ttim_i)\, e\, PWM_i + \sum_{ij} PC_{ij}\, tmrg_{ij,i}\right) \tag{60}$$

Based on the previous two equations, the weighted sum of the prices paid for domestically produced and imported products yields the price of the composite product (equation 61).

$$PC_i = \frac{PM_i\, IM_i + PD_i\, DD_i}{Q_i} \tag{61}$$

Four price indexes have been constructed, namely the GDP deflator (equation 62), the consumer price index (equation 63), the investment price index (equation 64), and the public expenditures price index (equation 65). The GDP deflator is measured by a Fisher index, while the consumer price index is measured by a Laspeyres index. On the other hand, the investment price index and the public expenditure price index are both considered exact price indexes.

$$GDPPIX = \sqrt{\frac{\sum_j \left(PVA_j + \frac{TIP_j}{VA_j}\right) VA_j^0 \sum_j (PVA_j VA_j + TIP_j)}{\sum_j \left(PVA_j^0 VA_j^0 + TIP_j^0\right) \sum_j \left(PVA_j^0 + \frac{TIP_j^0}{VA_j^0}\right) VA_j}} \quad (62)$$

$$CPIX = \frac{\sum_i PC_i \sum_h C_{i,h}^0}{\sum_i PC_i^0 \sum_h C_{i,h}^0} \quad (63)$$

$$INVPIX = \prod_i \left(\frac{PC_i}{PC_i^0}\right)^{\gamma_i^{INV}} \quad (64)$$

$$GVTPIX = \prod_i \left(\frac{PC_i}{PC_i^0}\right)^{\gamma_i^{GVT}} \quad (65)$$

Block of equilibrium equations. In order to ensure equilibrium in both the goods and services market as well as the factor market, it is necessary to establish a balance between supply and demand. This balance is represented by various equations, such as Equation 66, which defines the equilibrium between supply and demand for all commodities except for one in the domestic market. Equations 67 and 68 ensure that the total demand for labor factor is equal to the available supply and that the demand for capital factor for a given industry is equal to the supply in the same industry due to the fact that capital is sector-specific. Additionally, Equation 69 states that the total investment expenditure must equal the sum of agents' savings.

$$Q_{i1} = \sum_h C_{i1,h} + CG_{i1} + INV_{i1} + VST_{i1} + DIT_{i1} + MRGN_{i1} \quad (66)$$

$$LS = \sum_j LD_j \quad (67)$$

$$KS_j = KD_j \quad (68)$$

$$TI = \sum_h SH_h + SF + SG + SROW \quad (69)$$

To further maintain equilibrium, Equation 70 asserts that the total supply of every commodity produced locally must match the domestic demand for that commodity. Equation 71 confirms that the supply to the export market of each good must be equal to the demand for that good. Finally, the equilibrium on the nth market is ensured by equation 72, which represents the verification of Walras's law. In summary, it is crucial to uphold these equations to ensure general equilibrium.

$$\sum_j DS_{j,i} = DD_i \quad (70)$$

$$\sum_j EX_{j,i} = EXD_i \quad (71)$$

$$Leon = Q_n - \sum_h C_{n,h} - CG_n - INV_n - VST_n - DIT_n - MRGN_n \quad (72)$$

Block of GDP equations. Equations 73 to 76 provide a comprehensive understanding of GDP in different contexts. GDP at basic prices, as stated in Equation 73, is equivalent to the payments made to factors plus taxes on production. On the other hand, GDP at market prices exceeds the former by the exact amount of taxes on products and imports, as expressed in Equation 74. Moving on to GDP at market prices from the income perspective, as shown in Equation 75, it is the sum of total income paid to labor and capital along with taxes on products and imports as well as taxes on production. Finally, GDP at market prices from the final demand perspective is the total sum of net final expenditures, which encompasses household consumption, current government expenditures on goods and services, investment expenditures, as well as the value of exports minus imports, as indicated in Equation 76.

$$GDP^{BP} = \sum_j PVA_j VA_j + TIPT \quad (73)$$

$$GDP^{MP} = GDP^{BP} + TPCTS \quad (74)$$

$$GDP^{IB} = W \sum_j LD_j + \sum_j R_j KD_j + TIPT + TPCTS \quad (75)$$

$$GDP^{FD} = \sum_i PC_i \left(\sum_h C_{i,h} + CG_i + INV_i + VST_i\right) + \sum_i PE_i^{FOB} EXD_i - e \sum_i PWM_i IM_i \quad (76)$$

Overall, these equations provide a clear and concise representation of the various components that contribute to GDP in different contexts.

Block of real (volume) variables equations. The computation of real household consumption, real government expenditures, real gross fixed capital formation, and real GDP at basic and market prices from the nominal variables involve the use of appropriate indexes. This process is necessary to accurately account for changes in price levels after the simulations wished to be studied and obtain a more accurate picture of economic activity. Specifically, Equation 77 provides a means of calculating real household consumption, while Equation 78 pertains to real public expenditures. Real gross fixed capital formation is computed using Equation 79. Real GDP at basic and market prices are also determined through the use of relevant indexes (equations 80 and 81).

$$CTH_h^{REAL} = \frac{CTH_h}{CPIX} \quad (77)$$

$$G^{REAL} = \frac{G}{GVTPIX} \quad (78)$$

$$GFCF^{REAL} = \frac{GFCF}{INVPIX} \quad (79)$$

$$GDP^{BP\_REAL} = \frac{GDP^{BP}}{GDPPIX} \quad (80)$$

$$GDP^{MP\_REAL} = \frac{GDP^{MP}}{GDPPIX} \quad (81)$$

Welfare measure equation. The impact of policy changes on the welfare of various household groups was assessed by adding to the model the Equivalent Variation (EV) measure (equation 82). According to Decaluwé *et al.* (2001), EV is an appropriate measure of changes in well-being, as it calculates the increase or decrease in consumer income necessary to reach the utility level in the new situation that was achieved

in the reference situation. An EV that is positive indicates an improvement in the welfare of the group of households being studied, indicating that the utility generated by the policy simulation is higher than that in the reference situation, and *vice versa*. This approach was adopted in the model to estimate the impact of different simulated policies on household well-being and to complete our understanding of the income inequality later measured by the GINI index.

$$EV_h = \prod_i \left(\frac{PC_i^0}{PC_i}\right)^{\gamma_{i,h}^{LES}} \left(CTH_h - \sum_{ij} PC_{ij}\, C_{ij,h}^{MIN}\right) - \left(CTH_h^0 - \sum_{ij} PC_{ij}^0 C_{ij,h}^{MIN}\right) \quad (82)$$

2.2.2. Model Calibration and Closure

In order to apply our Computable General Equilibrium (CGE) model, it is necessary to assign values for various parameters and exogenous variables. The majority of these parameters are calibrated using data provided by the social accounting matrix (SAM) for the year 2019. However, it should be noted that the SAM alone may not be adequate for calibrating all parameters. In order to assign credible values to these remaining 'free parameters,' we referred to the empirical literature, specifically drawing upon the research conducted by Decaluwé *et al*. (2010). This approach enabled us to establish plausible values for the parameters that could not be calibrated based solely on the SAM data.

Regarding the closure of the model, we have set the exchange rate as the numeraire and fixed government spending and the current account balance. In our case, capital is not mobile between sectors, so we have fixed the demand for capital instead of its supply. Some variables are typically considered exogenous and are systematically fixed, such as minimum consumption, labor supply, stock variations, and world prices of imports and exports. Our choice of closure is therefore classical and ensured by the global investment being equal to the economy's total savings, as stated by Decaluwé *et al.* (2001). However, for specific simulations and due to scenario-specific reasons, we have endogenized current government spending and exogenized the value of government savings to account for the various possible alternatives that the government might adopt in response to the simulated policies.

3. SIMULATION OF ECONOMIC POLICIES

The CGE model constructed was used to simulate the effects of certain economic policies on the economy and the living levels of different household groups. In the following, we will present the simulated scenarios and their results.

3.1. Simulated Scenarios

The economic policies simulated in this context relate to an aspect of international trade that raises as much doubt in Morocco regarding the choice between further pushing the liberalization of foreign trade or taking a step back from this subject, even imposing a certain degree of tightening on it. The main thing in this debate is to keep in mind the corollaries of these policies on economic growth and their social cost to different categories of households.

3.1.1. Trade Liberalization Policy

The first policy analyzed in this study is the complete elimination of customs tariffs on all products imported by Morocco. Three scenarios result from this policy, considering alternative government policies. In the first simulation (SIM 1), in response to the complete elimination of customs tariffs, the government savings in value are assumed to be endogenous and variable following the shock, while current public expenditures are assumed to be exogenous and fixed at their base values. In the second simulation (SIM 2), still in response to the complete elimination of customs tariffs, the government savings in value are assumed to be exogenous and fixed, while current public expenditures are assumed to be endogenous and undergo adjustments. In contrast to these first two closures, in the third simulation (SIM 3), it is assumed that the government, to maintain its budget balance, will choose to compensate for the value of its loss in customs revenues due to the complete elimination of customs tariffs with a 10% increase in indirect taxes on all products.

3.1.2. Protection Policy

In the context of anti-trade liberalization, the second policy analyzed in this study is the exact opposite of the first, as it aims to double the customs duties on all products imported by Morocco. Given alternative government policies, three scenarios result from this policy: in the fourth simulation (SIM 4), it is assumed that the value of government savings is endogenous, while in the fifth simulation (SIM 5), current government spending is endogenous. In the sixth simulation (SIM 6), it is assumed that the government, in order to maintain its budget balance, will choose to reduce indirect taxes on all products by 10%, which is the same value as its gains from doubling the customs duties on all products.

The choice of the value of the shocks, *i.e.*, the complete elimination of customs tariffs in the first policy and the doubling of these tariffs in the second policy, is justified for two reasons. First, several empirical studies suggest that in the absence of an explicit agenda for trade reforms, analyzing extreme values can be relevant and informative for understanding the distributive impacts of real scenarios, including maximum gains or losses (Cockburn, Decaluwé, & Fofana, 2010). Second, even though we eliminated tariffs by 100% initially and then increased them by the same percentage, the sum of these revenues accounts for only 2% of the government's total revenue. Therefore, contrary to what it may seem, the value of the shocks is minimal.

3.2. Presentation of Results

3.2.1. Effects on Macroeconomic Aggregates

SIM 1. The elimination of customs duties in the first simulation resulted in a shift in demand towards imported goods, particularly in the primary and manufacturing sectors, leading to a decline in production and job losses in those sectors. Factor remuneration prices decreased, contributing to a reduction in total incomes for economic agents. This, in turn, led to a decrease in household consumption budgets and total investment value. The decline in demand, both intermediate and final, resulted in reduced government revenue from indirect taxes on commodities. Overall, the first simulation

demonstrated the complex and interconnected nature of these effects on the economy, ultimately negatively impacting GDP.

SIM 2. The second simulation demonstrates that the removal of customs duties with fixed government savings leads to a shift in demand towards imported goods, which are priced lower compared to local alternatives, with a significant decline in the production of the public administration sector. Employment losses occur in this sector. The equilibrium in the labor market is maintained through wage adjustments, resulting in declining wage rates. Additionally, rates of return on capital decrease in all sectors, with the public administration sector experiencing a more pronounced decline. The overall effect is a reduction in total income for economic agents, leading to declines in household consumption budgets and current public expenditures. Furthermore, the decline in demand, especially in its final form, leads to reduced government revenue from indirect taxes on products. These findings underscore the intricate distributional consequences of this policy, including negative impacts on GDP, government revenue, and current expenditures.

SIM 3. The third simulation, which involves the elimination of customs duties combined with an increase in indirect taxes on products, leads to a shift in demand towards more attractively priced commodities. The production structure responds by shifting towards the tertiary sector, while the primary and secondary sectors experience a decline. However, government revenue from production taxes decreases as a result. Job losses occur in sectors with reduced production. Wage rates are adjusted downward to maintain labor market equilibrium. Rates of return on capital also decrease across all sectors. Economic agents experience a decline in income due to decreased factor remuneration, leading to a reduction in household, business, and government incomes, although government revenue from indirect taxes on products increases. The total household consumption budget declines more significantly than current public expenditures. Total investment value decreases primarily due to lower savings among non-government agents. Overall, the analysis highlights the transmission mechanisms of this shock, resulting in negative impacts on GDP at both basic and market prices.

SIM 4. The fourth simulation, which involves doubling customs tariffs on all products, led to a demand shift towards products with more attractive prices, prompting an increase in the supply of goods in the local market, particularly from the primary and secondary sectors. This shift in production structure is reflected in higher sectoral value added and total intermediate consumption in these sectors. Despite a decrease in production in the tertiary sector, government revenue from production taxes increased. The labor market experienced increased demand in sectors with production growth. Wage rates were adjusted upward to achieve labor market equilibrium. Capital returns exhibited a greater increase in the primary and secondary sectors compared to the tertiary sector. The higher factor remuneration rates resulted in increased incomes for economic agents, leading to overall growth in total incomes, household consumption budgets, and total investment. Through analyzing the transmission channels of this shock, we have gained insights into the factors driving the positive growth rate of GDP.

SIM 5. The fifth simulation, which involves doubling customs duties with fixed government savings, has resulted in a change in demand structure driven by variations in product prices based on their origin. As a result, the supply has shifted towards the local market, particularly in public sector products. The rise in production within this sector has contributed to increased government revenue from production taxes. The labor market has witnessed a strong demand for workers in the public sector, leading to an upward adjustment in wage rates. The rate of return on capital has seen a more significant increase in the public sector compared to other sectors. Economic agents' total income has increased due to positive contributions from factor remuneration, resulting in an increase in household consumption budgets, albeit lower than the increase in current public expenditures. The rise in savings among non-government agents has facilitated the increase in total investment. Moreover, the substantial increase in final demand has played a crucial role in the observed growth of government revenue from indirect taxes on products. Overall, this analysis highlights the distributive consequences, ultimately leading to a favorable influence on GDP.

SIM 6. In the sixth simulation, where customs duties were doubled and indirect taxes on all products were reduced by 10%, there was a shift in demand towards domestic products due to their competitive prices compared to imports. Consequently, the supply also shifted towards the local market as producers received higher prices for selling their goods domestically. This led to an overall increase in aggregate production in the primary and secondary sectors, while the tertiary sector experienced a decline. Job losses were observed in this sector, but there was additional demand for labor in other sectors, resulting in an upward adjustment in wage rates to restore labor market equilibrium. The rate of return on capital saw a relatively greater increase in the primary and secondary sectors. Higher incomes from factor returns contributed to an overall rise in economic agents' earnings, leading to increased household consumption budgets and current public expenditures. Moreover, total investment grew, driven by increased savings from households and businesses. This analysis underscores the potential for resource reallocation and positive impacts on overall economic performance, as reflected in a favorable GDP growth rate.

3.2.2. Effects on Income Inequality And Living Levels of Households

SIM 1. The first simulation revealed different outcomes for various household groups. The income of the poorest households experienced a relatively smaller decrease compared to other groups. The decline of the consumer price index contributed to a slight increase in consumption volume for all households, but more prominently for the poorest ones. The welfare measure (Equivalent Variation) showed positive values, indicating an overall improvement in well-being for all groups, with middle-income households benefiting the most, followed by the lowest income group, and then the highest income group. Additionally, the analysis demonstrated a minor reduction in income inequality, as reflected in the GINI index, suggesting a decrease in inequality across social classes. These findings highlight the positive impact of removing customs duties while maintaining constant public

Table 1. Summary of the macroeconomic effects, in %.

Variables	Trade Liberalization Policy			Protection Policy		
	Elimination of Customs Duties on all Products			Doubling of Customs Duties on all Products		
	SIM 1	SIM 2	SIM 3	SIM 4	SIM 5	SIM 6
GDP at basic prices	-0,6397	-1,2285	-1,1380	0,6335	1,1962	1,1162
GDP at market prices	-1,5064	-2,0156	-0,9936	1,4899	1,9666	0,9337
Total income of households	-0,7041	-1,3553	-1,0652	0,6979	1,3222	1,0370
Total income of businesses	-0,7517	-1,0653	-1,1396	0,7444	1,0369	1,1262
Total government income	-3,1851	-3,4560	-0,6590	3,1498	3,3790	0,5294
Rest-of-the-world income	0,1405	0,2653	0,1841	-0,1338	-0,2480	-0,1740
Total consumption budget of households	-0,7038	-1,3485	-1,0677	0,6975	1,3155	1,0398
Current government expenditures	0	-5,5980	-0,6977	0	5,4683	0,4722
Savings of households	-0,7075	-1,4128	-1,0445	0,7013	1,3789	1,0132
Savings of businesses	-0,7574	-1,0779	-1,1326	0,7501	1,0495	1,1187
Government savings	-28,1916	0	0	27,8602	0	0
Total investment expenditures	-3,6102	-0,6193	-0,6224	3,5687	0,6032	0,6136

Source: Authors' calculation.

expenditures on living standards and income inequality among households.

SIM 2. In the second simulation, all household categories experienced a decline in their incomes, but the wealthiest households saw a relatively greater decrease compared to the poorest and middle-class households. However, the decline in the consumer price index led to a slight increase in consumption volume for all households, with the middle-income group benefiting the most. The welfare measure, equivalent variation, showed positive values for all household categories, indicating an improvement in overall well-being. Middle-income households derived the greatest benefits from the policy change. Moreover, the analysis revealed a slight decrease in income inequality, as indicated by the GINI index, suggesting that the removal of customs duties contributed to a reduction in internal income inequality. These findings underscore the positive effects of the simulation even without maintaining constant public expenditures on household living levels and income disparities.

SIM 3. In the third simulation, where customs duties are eliminated and indirect taxes on all products are increased to maintain government budget equilibrium, all household groups experienced a decline in their incomes, with the wealthiest households being less affected compared to others. Although there was a slight decrease in the consumer price index, the consumption volume decreased, particularly for middle-class and poorer households, while the wealthiest households saw a smaller decrease. The welfare measure (EV) showed negative values, indicating a decline in well-being for all households, especially the wealthiest ones. The increase in the GINI index suggests that the relatively larger income decrease for middle- and lower-income households, compared to wealthier households, contributed to an increase in internal income inequality. These findings highlight the adverse effects of the simulation on household living levels and income disparities.

SIM 4. The fourth simulation, which involves doubling customs duties while keeping public expenditures unchanged, has yielded contrasting effects on household groups. All households experienced an increase in income, with the wealthiest households benefiting the most. However, this was accompanied by a decrease in consumption volume for all households due to the rise of the consumer price index, with the impact being less severe for the wealthiest. Welfare, as measured by the equivalent variation, declined for all groups, but middle-income households and the wealthiest experienced a greater deterioration. Moreover, the GINI index exhibited a positive variation, indicating an increase in internal income inequality. These findings highlight the unequal distributional consequences of the policy change.

SIM 5. In the context of the fifth simulation, the shock implemented resulted in an increase in household incomes across all groups, albeit with a less favorable impact on middle-class households. However, the rise in the consumer price index led to a decrease in consumption volume for all households, with the middle-class households experiencing the largest decline, followed by the poorest and then the wealthiest households. The welfare measure (EV) exhibited negative values for all household categories, indicating a decline in well-being, particularly affecting the middle-income and wealthiest households, albeit to a lesser extent for the poorest. These findings underscore the widening income gap between social classes, as supported by the positive variation in the GINI index, signifying an increase in internal income inequality resulting from the simulated policy.

Table 2. Summary of the effects on income inequality and the living levels of households.

Variables	Household Groups	Trade Liberalization Policy			Protection Policy		
		Elimination of Customs Duties on all Products			Doubling of Customs Duties on all Products		
		SIM 1	SIM 2	SIM 3	SIM 4	SIM 5	SIM 6
Total income of type h households in %	PHH	-0,6849	-1,3387	-1,0800	0,6787	1,3055	1,0525
	MHH	-0,7038	-1,2905	-1,0871	0,6974	1,2583	1,0621
	WHH	-0,7064	-1,4071	-1,0469	0,7003	1,3733	1,0159
Real consumption budget of type h households in %	PHH	0,4947	0,2356	-0,3129	-0,4810	-0,2328	0,3197
	MHH	0,4755	0,2846	-0,3200	-0,4625	-0,2793	0,3293
	WHH	0,4729	0,1661	-0,2795	-0,4597	-0,1660	0,2833
Consumer price index in %		-1,1738	-1,5706	-0,7695	1,1653	1,5419	0,7305
Equivalent variation (EV divided by the personal income of the reference situation)	PHH	326	145	-130	-316	-144	134
		(0,038)	(0,017)	(-0,015)	(-0,036)	(-0,017)	(0,015)
	MHH	2010	1143	-1054	-1946	-1123	1091
		(0,095)	(0,054)	(-0,050)	(-0,092)	(-0,053)	(0,051)
	WHH	1551	554	-1262	-1502	-549	1283
		(0,019)	(0,007)	(-0,015)	(-0,018)	(-0,007)	(0,016)
GINI INDEX (in %)		0,38158	0,38137	0,38169	0,38162	0,38182	0,38150
		(-0,005)	(-0,061)	(0,023)	(0,005)	(0,058)	(-0,025)

Source: Authors' calculation.

SIM 6. In the sixth simulation, where customs duties were doubled and tax rates on all products were reduced, there was an overall increase in income for all households, with the middle class and the poorest households benefiting the most. Despite an increase in the consumer price index, the volume of consumption for all households also increased, particularly favoring the middle class and the poorest. The welfare measure showed positive values for all household groups, indicating an improvement in their well-being, with the wealthiest households experiencing the greatest benefit, followed by the middle class, and finally the poorest. Furthermore, a reduction in internal income inequality was confirmed by the negative variation in the GINI index, reflecting the positive distributive effects of the simulated policy.

4. DISCUSSION OF THE MAIN FINDINGS

Having thoroughly examined the distributional impacts of each simulation on the overall economy, considering the transmission channels of the studied shock and its effects on the living levels of diverse household groups supported by measures of welfare and inequality, we will now present an alternative interpretation of these findings. This alternative reading allows us to evaluate the simulated policies and draw the most significant conclusions regarding the interconnectedness of foreign trade, economic growth, and income inequality.

The overarching analysis of these results reveals that in terms of GDP growth, the impact of complete trade liberalization under the three closure scenarios is negative, while the impact of the anti-liberal trade policy is positive under all closure scenarios. The endogenization of public expenditures has played a crucial role in magnifying these outcomes, regardless of the specific policy pursued. In the context of a small open economy, these findings contradict the previously suggested positive relationship between trade openness and economic growth. However, they are consistent with the insights put forth by Rodrik (2005) in emphasizing the importance of adopting appropriate trade policies that can contribute to economic growth. It is evident that the outcomes observed in this study underscore the significance of selecting the most suitable external trade policies, which align with the notion that countries must carefully consider the implications of trade liberalization on their economic performance.

However, in terms of improving households welfare and reducing internal income inequality, the observed distributive impacts of trade liberalization align more closely with these expectations than those observed from doubling customs duties. However, this result is contingent on the condition that, in the case of liberalization, the government does not compensate for its loss of revenue from import taxes. In other words, the government is faced with two bitter choices: either widening its budget deficit or reducing its current expenditures. In the other case, it requires a reduction in indirect taxes on products.

It is crucial to keep in mind that the findings discussed in this study are assumed to represent the maximum potential gains or losses resulting from the examined shocks. However, it

should be noted that the impact on welfare and inequality measures is overall modest and statistically less significant in comparison to that on GDP growth. The limited magnitude of these measures highlights the weak relationship between trade policy and income inequality, regardless of whether it is liberal or protectionist in nature. Our findings then align with those of Dollar and Kraay (2004) concerning the significance of trade liberalization policies. However, they are more closely aligned with the results of Abdelkhalek (2005) in highlighting that the impact, albeit present, is generally modest and statistically less significant.

5. CONCLUSION

In conclusion, this article presents a comprehensive analysis of the distributive effects of trade policy shocks, specifically the complete elimination and doubling of customs duties, on macroeconomic aggregates, inequalities, and the living levels of households. The study conducted six simulations to examine the multifaceted implications of these shocks.

Based on the findings of this study, the impact of trade liberalization on GDP growth is negative, while the impact on improving household welfare and reducing income inequality aligns more closely with these expectations compared to doubling customs duties. However, the impact on welfare and inequality measures is modest and statistically less significant compared to GDP growth. These results highlight a weak relationship between international trade policies and internal income inequality, whether they are liberal or protectionist.

Given these facts, policymakers in Morocco should carefully consider the trade-offs and implications of further pushing trade liberalization. Although trade liberalization may have a positive impact on household welfare and income inequality, it is crucial to consider the potential negative effects on GDP growth. Policymakers should assess the specific conditions and context of the Moroccan economy to determine the potential risks and benefits of trade liberalization.

Taking a step back or considering certain hardening measures on trade liberalization might be necessary if the negative impact on GDP growth in the case of trade liberalization policies is a significant concern or if other factors such as protecting domestic industries or managing government revenue become crucial considerations. Policymakers should weigh the potential benefits of trade liberalization against the associated challenges and carefully analyze the trade-offs before making any decisions.

Ultimately, the optimal approach would depend on the specific goals, priorities, and potential risks involved. Policymakers should aim for a balanced approach that considers the welfare of households, economic growth, and income inequality to make informed decisions regarding trade liberalization.

CONFLICT OF INTEREST

We declare that we have not benefited from any sponsorship or funding agreement related to this research work and that we have no conflict of interest.

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APPENDICES

Appendix 1. The Social Accounting Matrix's structure, accounts, and dimensions.

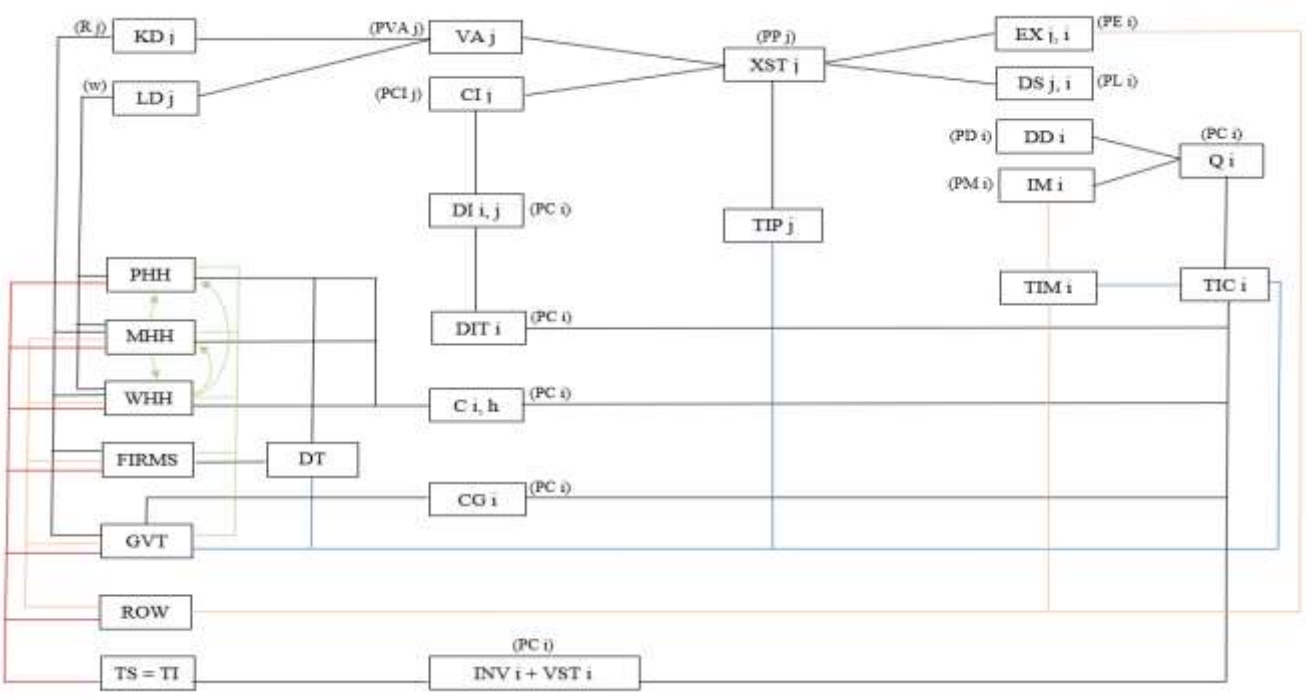
SAM			Production factors		Institutional agents							Industries	Commodities		Accumulation		TOTAL
			Labor	Capital	Households	Firm	GVT	TD	TM	TI	ROW	J	I	X	INV	VSTK	
			1	1	3	1	1	1	1	1	1	28 (4) [3]	28 (5)	28 (4)	1	1	
Production factors	Labor	1										Wages paid by industry J to labor factor					Total labor factor income
	Capital	1										Remuneration of Capital Factor Paid by Industry J					Total capital factor income
Institutional agents	Households	3	Labor income received by household H	Capital income received by household H	Transfers from household H to household H	Transfers from Firms to household H	Transfers from GVT to household H				Transfers from ROW to household H						Total households income
	Firm	1		Capital	Transfers	Transfers	Transfers				Transfers						Total firms

[3] The dimensions in parentheses are those taken in the modeling part.

				income received by firms	from household H to firm	from firms to firms	from GVT to firm				from ROW to firms						income
	GVT	1		Capital income received by GVT	Transfers from household H to GVT	Transfers from firms to GVT	Transfers from GVT to GVT	Total direct taxes	Total import duties	Total indirect taxes	Transfers from ROW to GVT	Net taxes on production paid by industry J		Taxes on exports X			Total government income
	TD	1			Income taxes paid by household H	Direct taxes paid by firms											Total direct taxes
	TM	1											Import duties on imports I				Total import duties
	TI	1											Net indirect taxes on commodity I				Total indirect taxes
	ROW	1			Transfers from household H to ROW	Transfers from firms to ROW	Transfers from GVT to ROW						Imports of commodity I (excluding taxes and margins)				Total income of the rest of the world
Industries	J	28											Supply of commodity I on the local market by sector J (excluding taxes and margins)	Supply of commodity X on the export market by sector J (excluding taxes and margins)			Total industries income
Commodities	I	28			Consumption of commodi-ties by household H		Current public consumption of commodi-ty I					Intermediate demand of commodity I by industry J	Purchases of commodity I as margins on local purchases of composite commodity I	Purchases of commodity I as margins on exports of exports X	Demand of composite commodity I for investment purposes (GFCF)	Inventory changes of composite commodity I	Total income of commodity I
	X	28									Exports of commodity X (including taxes and margins) (excluding taxes and margins)						Total income of commodity X
Accumulation	INV	1			Household H savings	Firms savings	GVT savings				ROW savings						Total savings
	VSTK	1													Total inventory changes		Total inventory changes
TOTAL			Total labor factor expenditures	Total capital factor expenditures	Total households expenditures	Total firms expenditures	Total government expenditures	Total direct taxes	Total import duties	Total indirect taxes	Total expenditures of the rest of the world	Total industries expenditures	Total expenditures of com-modity I	Total expenditures of com-modity X	Total investments	Total inventory changes	

Source: Authors.

Appendix 2: General structure of the model.



Source: Authors

Appendix 3: Effects on other economic variables.

Variables	Sectors & Products	Trade Liberalization Policy			Protection Policy		
		Elimination of Customs Duties on all Products			Doubling of Customs Duties on all Products		
		SIM 1	SIM 2	SIM 3	SIM 4	SIM 5	SIM 6
Quantity of product m imported	agr	2,2331	2,7165	2,2196	-2,1219	-2,5733	-2,0944
	ser	-1,3750	-3,6659	-2,3258	1,3721	3,6436	2,2532
	adm	-0,7597	-7,1177	-1,5789	0,7539	7,1350	1,3182
	man	0,5443	1,0246	0,6830	-0,5379	-1,0007	-0,6600
	othind	-2,9056	-0,6657	-0,7840	2,8450	0,6147	0,7533
Domestic demand for commodity i produced locally	agr	-0,3499	-0,0502	-0,3101	0,3386	0,0495	0,3103
	ser	0,1507	0,1097	-0,0052	-0,1491	-0,1148	0,0062
	adm	0,3814	-3,2901	0,1761	-0,3735	3,1066	-0,3190
	man	-0,6736	0,0414	-0,7534	0,6597	-0,0268	0,7711
	othind	-1,0201	0,6027	-0,1071	0,9762	-0,5785	0,1297
Quantity of product x exported by sector j	agr	1,2954	1,4899	1,3119	-1,2518	-1,4236	-1,2582
	man	1,1802	1,7674	0,9837	-1,1433	-1,6786	-0,9240
	othind	1,1842	1,7190	0,9943	-1,1470	-1,6345	-0,9366
	ser	0,6421	1,4972	0,9201	-0,6287	-1,4178	-0,8659
Total aggregate output of industry j	agr	-0,1540	0,1143	-0,0991	0,1507	-0,1062	0,1061
	ind	-0,2963	0,6365	-0,1492	0,2897	-0,5997	0,1806

	ser	0,1446	0,2680	0,0770	-0,1426	-0,2612	-0,0685
	adm	0,2955	-3,2092	0,1545	-0,2887	3,0291	-0,2932
Demand for labor by industry j	agr	-1,3194	0,9861	-0,8500	1,3007	-0,9110	0,9149
	ind	-0,9351	2,0221	-0,4711	0,9180	-1,8881	0,5720
	ser	0,3834	0,7113	0,2042	-0,3776	-0,6910	-0,1813
	adm	0,3678	-3,9834	0,1922	-0,3592	3,7790	-0,3648
Total intermediate demand for commodity i	agr	-0,2457	0,5078	-0,1278	0,2402	-0,4785	0,1530
	ser	0,0544	-0,0959	0,0302	-0,0539	0,0858	-0,0353
	man	-0,1905	0,4476	-0,0968	0,1860	-0,4230	0,1186
	othind	-0,1118	0,1944	-0,0550	0,1089	-0,1852	0,0649
Price of imported product m (including all taxes and tariffs)	agr	-2,5946	-2,7015	-2,5829	2,5937	2,6958	2,5772
	ser	0,1491	0,3906	0,6819	-0,1472	-0,3778	-0,6668
	man	-1,9672	-2,0714	-1,3291	1,9664	2,0659	1,2986
	othind	-0,7008	-0,7100	-0,1226	0,7008	0,7095	0,1139
Price of local product i sold on the domestic market (including all taxes and margins)	agr	-1,3403	-1,3640	-1,3547	1,3280	1,3408	1,3403
	ser	-0,6166	-1,5207	-0,4933	0,6105	1,4792	0,4429
	adm	-0,5700	-1,9989	-0,8798	0,5642	1,9348	0,8179
	man	-1,3680	-1,5914	-0,6177	1,3580	1,5675	0,5768
	othind	-1,6512	-1,3379	-0,4615	1,6283	1,3121	0,4252
Price received for exported commodity x (excluding export taxes)	agr	-0,6606	-0,6158	-0,7024	0,6503	0,6035	0,6942
	ser	-0,3433	-0,8040	-0,4493	0,3393	0,7782	0,4255
	man	-0,5913	-0,7955	-0,5051	0,5827	0,7766	0,4859
	othind	-0,5893	-0,8191	-0,4999	0,5808	0,7992	0,4795
Price received for local product i (excluding all taxes on products)	agr	-1,4667	-1,3671	-1,4974	1,4535	1,3470	1,4878
	ser	-0,6001	-1,4799	-0,9093	0,5940	1,4381	0,8692
	adm	-0,5700	-1,9989	-0,8798	0,5642	1,9348	0,8179
	man	-1,4941	-1,6292	-1,3702	1,4835	1,6082	1,3479
	othind	-1,6641	-1,3378	-1,0436	1,6411	1,3122	1,0194
Price of industry j value added	agr	-1,2825	-1,0725	-1,5596	1,2704	1,0561	1,5634
	ind	-0,9322	-0,7420	-1,2760	0,9217	0,7226	1,2829
	ser	-0,3488	-1,3531	-0,9794	0,3447	1,3104	0,9439
	adm	-0,4590	-2,1679	-1,0383	0,4551	2,0949	0,9716
Purchaser price of composite comodity i (including all taxes and margins)	agr	-1,5166	-1,5522	-1,5273	1,5022	1,5271	1,5105
	ser	-0,5454	-1,3447	-0,3843	0,5391	1,3023	0,3379
	adm	-0,5695	-1,9970	-0,8790	0,5637	1,9329	0,8171
	man	-1,6622	-1,8269	-0,9672	1,6549	1,8109	0,9288
	othind	-1,5757	-1,2879	-0,4344	1,5534	1,2635	0,4002
Rental rate of capital in industry j	agr	-1,3839	-0,9972	-1,6247	1,3721	0,9845	1,6352
	ind	-1,1280	-0,3212	-1,3742	1,1166	0,3196	1,4048

	ser	-0,2527	-1,1769	-0,9286	0,2493	1,1339	0,8978
	adm	-0,2630	-4,2723	-0,9364	0,2616	4,1463	0,7741
Wage rate of labor		-0,5068	-1,6427	-1,0632	0,5024	1,6025	1,0200
GVT revenue from business income taxes		-0,7148	-0,9832	-1,1845	0,7076	0,9554	1,1754
GVT revenue from household income taxes		-0,7058	-1,3856	-1,0543	0,6996	1,3521	1,0245
GVT receipts of taxes on commodities		-1,5104	-1,3216	8,4372	1,4977	1,2942	-8,7323
Total gvt revenue from import duties		-100	-100	-100	98,7748	97,7961	98,4907
Total gvt revenue from production taxes		-0,9160	-1,2440	-0,9602	0,9093	1,2153	0,9366
Real current government expenditures		0,5968	-3,9145	0,0078	-0,5834	3,7091	-0,1761
Gross fixed capital formation		-3,8582	-0,4839	-0,5801	3,8129	0,4681	0,5745
Real gross fixed capital formation		-2,3887	1,0483	0,0875	2,2892	-1,0090	-0,0544
Public expenditures price index		-0,5932	-1,7520	-0,7055	0,5868	1,6963	0,6495
GDP deflator		-0,6395	-1,2299	-1,1379	0,6333	1,1975	1,1160
Investment price index		-1,5055	-1,5162	-0,6670	1,4896	1,4921	0,6292

Source: Authors' calculation.

Appendix 4: Sets and variables.

- Sets

Industries	AGR	Primary sector
	IND	Secondary sector
	SER	Tertiary sector
	ADM	Public administration and social security
Commodities	AGR	Primary sector
	MAN	Manufacturing industries
	OTHIND	Other industries
	SER	Tertiary sector
	ADM	Public administration and social security
Agents	PHH	Poorest households
	MHH	Middle class households
	WHH	Wealthiest households
	FIRM	Firms
	GVT	Government
	ROW	Rest of the world
Production factors	L	Labor
	K	Capital

- Variables

Volume variables	$C_{i,h}$	Consumption of commodity i by type h households
	CG_i	Public final consumption of commodity i

	CI_j	Total intermediate consumption of industry j
	$CMIN_{i,h}$	Minimum consumption of commodity i by type h households
	CTH_h^{REAL}	Real consumption budget of type h households
	DD_i	Domestic demand for commodity i produced locally
	$DI_{i,j}$	Intermediate consumption of commodity i by industry j
	DIT_i	Total intermediate demand for commodity i
	$DS_{j,i}$	Supply of commodity i by sector j to the domestic market
	$EX_{j,i}$	Quantity of product i exported by sector j
	EXD_i	World demand for exports of product x
	G^{REAL}	Real current government expenditures on goods and services
	GDP^{BP_REAL}	Real GDP at basic prices
	GDP^{MP_REAL}	Real GDP at market prices
	$GFCF^{REAL}$	Real gross fixed capital formation
	IM_i	Quantity of product i imported
	INV_i	Final demand of commodity i for investment purposes (GFCF)
	KD_j	Demand for capital by industry j
	KS_j	Supply of capital by industry j
	LD_j	Demand for labor by industry j
	LS	Supply of type l labor
	$MRGN_i$	Demand for commodity i as a trade or transport margin
	Q_i	Quantity demanded of composite commodity i
	VA_j	Value added of industry j
	VST_i	Inventory change of commodity i
	$XS_{j,i}$	Industry j production of commodity i
	XST_j	Total aggregate output of industry j
Price variables	*e*	Exchange rate (price of foreign currency in local currency)
	Pj,i	Basic price of industry j's production of commodity i
	PC_i	Purchaser price of composite commodity i (including all taxes and margins)
	PCI_j	Intermediate consumption price index of industry j

	PD_i	Price of local product i sold on the domestic market (including all taxes and margins)
	PE_i	Price received for exported commodity i (excluding export taxes)
	PE_i^{FOB}	FOB price of exported commodity i (in local currency)
	CPIX	Consumer price index
	GDPPIX	GDP deflator
	GVTPIX	Public expenditures price index
	INVPIX	Investment price index
	PL_i	Price of local product i (excluding all taxes on products)
	PM_i	Price of imported product i (including all taxes and tariffs)
	PP_j	Industry j unit cost excluding other taxes on production
	PT_j	Basic price of industry j's output
	PVA_j	Price of industry j value added
	PWM_i	World price of imported product i (expressed in foreign currency)
	PWX_i	World price of exported product i (expressed in foreign currency)
	R_j	Rental rate of capital in industry j
	W	Wage rate of labor
Nominal (value) variables	*CAB*	Current account balance
	CTH_h	Consumption budget of type h households
	G	Current government expenditures on goods and services
	GDP^{BP}	GDP at basic prices
	GDP^{FD}	GDP at purchasers' prices from the perspective of final demand
	GDP^{IB}	GDP at market prices (income-based)
	GDP^{MP}	GDP at market prices
	GFCF	Gross fixed capital formation
	TI	Total investment expenditures
	SF	Savings of type f businesses
	SG	Government savings
	SH_h	Savings of type h households
	SROW	Rest-of-the-world savings
	DTF	Income taxes of type f businesses
	DTH_h	Income taxes of type h households
	TDTH	Total government revenue from household income taxes

	TIC_i	Government revenue from indirect taxes on product i
	TICT	Total government receipts of indirect taxes on commodities
	TIM_i	Government revenue from import duties on product i
	TIMT	Total government revenue from import duties
	TIP_j	Government revenue from taxes on industry j production
	TIPT	Total government revenue from production taxes
	TPCTS	Total government revenue from taxes on products and imports
	$TR_{ag,agj}$	Transfers from agent agj to agent ag
	YDF	Disposable income of businesses
	YDH_h	Disposable income of type h households
	YF	Total income of businesses
	YFK	Capital income of businesses
	YFTR	Transfer income of businesses
	YG	Total government income
	YGK	Government capital income
	YGTR	Government transfer income
	YH_h	Total income of type h households
	YHK_h	Capital income of type h households
	YHL_h	Labor income of type h households
	$YHTR_h$	Transfer income of type h households
	YROW	Rest-of-the-world income
Other variables	*LEON*	Excess supply on the last market
	EV_h	Equivalent variation for type h households

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